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ENTREPRENEURIAL ASPECTS OF NANO – TECHNOLOGY IN DEVELOPING COUNTRIES

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ABSTRACT

This paper provides a comparative assessment for the cause of industrial development because of the advances in the field of nanotechnology and its successful adoption by young industries. A sincere attempt is made in summarizing the entrepreneurial opportunities in the field of nano technology and how the global market is exploring the possibilities of the advancements in Nano products. A proper coordination must exist between the technical innovation and its necessity by its end users at the market. Opportunities for entrepreneurs can be created by latest know-hows and novelties in the field of Nano technology.

KEYWORDS: Nanotechnology, Entrepreneurship, Management & Nano Products

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Original Article

INTRODUCTION

Background

Nanotechnology is the use of matter on a proximate-atomic measure to create novel structures, materials and devices. This technology helps to promote niche areas of industries such as mechanical, aerospace electrical medicine and etc, by exploring the possibilities of the materials at nano level. Todays trend is to go for products that are as small as possible with better performance and cost effectiveness, use of nanotechnology and its potentials by the industries in this regard have led them to reach international standards [1].

Many developments in Nanotechnology, like other creative ideas, finally originate from the man's mind, whether this man is a particular person or a small group of people. But this inventor’s act in defined and specific business places like universities, state laboratories and companies.

An Entrepreneur in the Nanotechnology field for finding needed basis for his or her company, should pay attention to the viewpoint of inventors.

Modernization of technology and its marketing are the primary causes for free enterprise and firm expansion. Inventions in the field of technology are measured as the key factors that lead to the entrepreneurial bustle. Then again entrepreneurial bustle can be considered as a source for creating inventions. By establishing a proper bondage between the inventions and the investors, it follows that guidelines favouring innovation exertions will possibly have an impact on entrepreneurial activity [2]. Technology based industrialists emphasize that invention, which is a combination of discovery and execution, depends on guidelines and policies that “embolden entrepreneurship, venturesome investment, and technological revolution”. Such invention guidelines and policies

must have patronage of monetary inventiveness and science and technology (S&T) initiatives leading to the growth and commercialization of innovations [3].

NATIONAL STATUS

The nanotechnology enterprise take by India is a multi- agency exertion which is in line with the foot marks of United States multi- agency model. India's Department of Science and Technology will invest around $20 million for their Nanomaterials Science and Technology Initiative every year. Panacea Biotech, New Delhi, India is piloting an innovative drug delivery investigation by means of cohesive nanoparticles, Dabur Research Foundation (Ghaziabad, India) and Department of Information Technology (DIT) will also be partaking in Phase-1 clinical tribunals of nanoparticle transfer of the anti-cancer medication paclitaxel [4]. Other agencies showing major involvement are the Department of Biotechnology (DBT), Council of Scientific and Industrial Research (CSIR), Ministry of New and Renewable Energy (MNRE), Ministry of Health and Family Welfare (MOHWF), Indian Council of Agricultural Research (ICAR), Indian Space Research Organization (ISRO), Department of Atomic Energy (DAE), and Defense Research and Development Organization (DRDO) [5]. Nanotechnology as a distinct area of government research started with NSTI (Nano Science and Technology Initiative) in the X plan period (2002-2007) with an allocation of rupees 60 crores (approx. USD 12 million). The NSTI was initiated and implemented by DST. The NSTI helped in establishing units for developing research excellence in nanoscience, centers for nanotechnology each aimed at application development and two national instrumentation/characterization facilities. In all, fourteen national institutions, including seven IITs and ten universities have been supported under the NSTI. The other major program that complimented the nanotechnology initiatives is the National Program for Smart Materials (NPSM) launched in 2012 [6].

In the year 2012 government, corporate agencies and investors spent around $18.5 billion, while it was just around 8% in 2010 [7]. U S contributed around 36% and the corporate sectors increased their investment by 21 % while the government agencies and private investors reduced by 10%.The United States was in leading position with $ 2.1 billion of federal and state funding. In the year 2012 U S spent around $2.4 billion on Nano research which was about $1 billion more than what Japan had spent [8]. The revenue from nano enabled products have increased considerably from $339 billion in 2010 to $731 billion in 2012. This is a slight decreased estimate made by industrial economists in contrast to last update on nano-enabled product revenues released in 2009 [9]. Further market projections for nano-enabled products reveals the global value of nano-enabled products, nano-intermediates, and nanomaterials reaching $4.4 trillion by 2018.

MODERN DEVELOPMENTS IN EXPLORATION OF NANO TECHNOLOGY

Use of composite materials to conventional monolithic alloys has become a common platform in today’s market. Application of nano technology in the manufacturing and production is gaining importance off late. Capability of nano particles to make the conventional material strong, stiff, durable and light in weight is well adopted by leading automobile manufacturing company of United States namely General Motors. Step assist which is a more common requirement in most of the SUVS today are made by clay nano particles which are durable and are opt for the purpose.

Common applications of Nano technology in the present world include and are not limited to the following

- **Nanocomposite Plastics and Carbon Nanotubes in Packaging**

  One of the important application of nanocomposite materials is in the packaging and upper atmosphere travel

segments. Nano composite plastics finds their suitability in industrial packing especially in case of electronic components due their added advantages. Since the current trend is to go for lighter materials with enhanced strength nano composite materials finds their way in most of the industries. The latest claim of the carbon nano tubes is in the food packaging industries where in these smart materials can sense and detect the status of the food which is stored in it [10, 11].

- **Nano Porous Compounds in Insulation and Microelectronics**

Nano porous silica amalgamates carry potentials for better insulating materials. This characteristic of nano compound coupled with low density and increased porosity makes it an ideal candidate for usage in broad range of temperature related applications like refrigerators, air conditioners and freezers to pipe insulation [12]. Microelectronics industries that need insulating materials with low dielectric constants are also benefited to a greater extent by the use of nano porous silica compounds.

- **Nanoparticles in Plastic and Colloids**

Nanoparticles are extremely active catalysts, and are being established for the use in plastic making industries, owing to the amplified surface area at such a small scale, to improve the properties and flexibility of the resultant materials. One of the important application of nanoparticles is in the making of colloids which in turn can be used in the making of sunscreens, copier inks and paints [13]. A magnificent example of the use of nano particles in sunscreen industry is the Zinc and titanium oxide sunscreens. These sunscreens do not disseminate light leaving the end product clear rather than white.

- **Nano Coatings**

Nano coatings have hit the market by storm. Nano coatings have come as a encouraging tool where in self assembling monolayers are developed which can even act as a scuff resilient coatings for glass to self-cleaning exteriors [14].

- **Smart Textiles**

Superior functionality and enhanced wear resistance are the key factors that can be obtained by the application nano technology in textile industries. Fabrics designed and manufactured with the above technology are multifunctional and finds their usage in a variety of applications for example ability to communicate with other devices, deport energy, transmute into other materials, subsequently shield from ecological menaces[15].

COMMERCIAL ANGLE

The major discovery of Buck ministers fullerene and invention of atomic force microscopy several prominent thinkers predicted the boom in industry and economy in future. According to one of the estimates, the world market for nanotechnology products will reach $25.2 billion in 2011 and over $1 trillion by 2015. China, Russia, and Saudi Arabia, among others, are vying for the leading role in this booming industry and are investing billions in nanotechnology for energy, biomedicine, environment, aerospace, and information technology [16].

Turning research innovations into commercialized products involves overcoming two big blockades: infrastructure and business development.

Infrastructure is one of the greatest hurdle. Research and development requires extensive laboratory space and high quality of scientific instruments. Most of the product oriented research must be carried out outside the universities laboratories due to IPR issues. R & D is not only to be restricted to universities, it should also be established as private labs.

Business development is the other crucial obstacle. As brilliant as a researcher may be in nanoscale science, business acumen requires a whole set of other skills. Incubations provide access to experts in intellectual property law, business planning, marketing, as well as to risk investments.

Thus, incubators that can collaborate with academia and research labs are important to the development of nanotechnology industry. Innovation clusters have begun in various cites to bring together universities, technology incubators, companies, and government labs. Examples of successful incubators focused on nanotechnology are the Northern California Nanotechnology Initiative, the Nano-Network of New Mexico, the Nanotechnology Institute in south eastern Pennsylvania, and the Nano World Headquarters in Texas [17].

The biggest obstacles to commercializing nanotechnology can be overcome by collaborating researchers and the business community together in suitable forum, can enable this promising technology to reach its full potential [18].

CONCLUSIONS

The present study addresses an important topic that has been neglected in entrepreneurship field. Although the research was centered on examining the role of the nanotechnology innovation, the implications of these findings are of significant importance to show that new business model is critical to translate the nanotechnology innovation into commercially successful products and process through nanotechnology adoption

Finally, future investigations could explore different aspects of nanotechnology innovation to gain a better understanding of the impact of the technology entrepreneurship and new business model on nanotechnology commercialization. Future research could examine new constructs and their relationships.

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